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Efficacy of Problem-Solving Interventions for Improving Executive Functioning Outcomes in Patients with Acquired Brain Injuries: A Systematic Review

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Background

- Individuals with brain injury often have deficits in executive functioning (EF) that impact their ability to successfully plan for and find solutions to everyday problems
- An individual must possess the four following skills in order to effectively problem-solve: 1) define and formulate the problem, 2) generate solutions, 3) make decisions, 4) implement and assess the solution
- Problem-Solving Therapy has been used as a metacognitive strategy to support problem-solving abilities in individuals with acquired brain injury (ABI)
- The following systematic review synthesizes the available research supporting the use of problem-solving therapy based on the framework first proposed by D'Zurilla and Goldfried (1971) to support EF improvement in individuals with ABI

Methods

- Three databases were searched: CINAHL, PsycINFO, Ovid Medline
- Exploded subject headings were: "brain injury" (or "traumatic brain injury") and "problem solving"
- Inclusion criteria: problem-solving intervention; EF outcomes
- Exclusion criteria: family-centered outcomes; case studies
- Studies assessed for quality and validity
- Results and data were extracted for analysis

Selected References

D'Zurilla, T.J., & Goldfriend, M. R. (1971). Problem solving and behavior modification. Journal of Abnormal Psychology, 78(1), 107-126.

D'Zurilla, T. J. & Nezu, A. M. (2010). Problem-solving therapy. In Dobson, K. S. (Ed.) *Handbook of cognitive-behavioral therapies* (pp. 197-225). New York, NY: Guilford Press

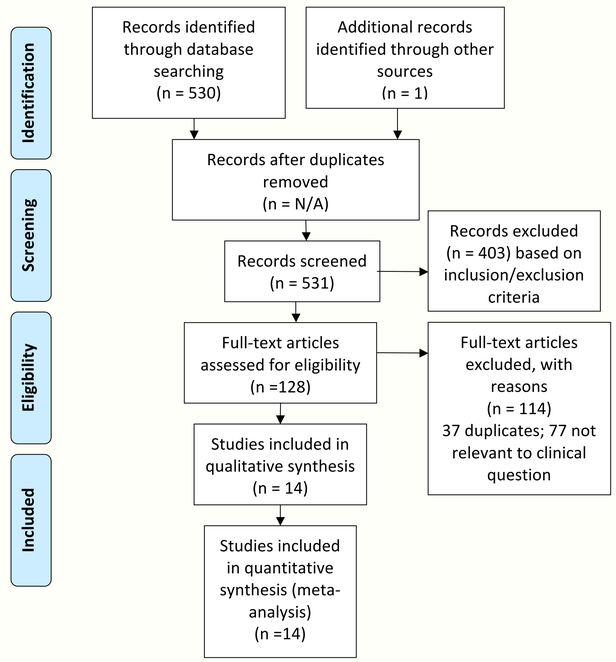
Kennedy, M. R. T., Coelho, C., Turkstra, L., Ylvisaker, M., Sohlberg, M. M., Yorkston, K., . . . Kan, P. (2008). Intervention for executive functions after traumatic brain injury: A systematic review, meta- analysis and clinical recommendations. Neuropsychological Rehabilitation, 18(3), 257-299.

Results

Table 1. Study Characteristics

Reference	Study Size	Age Range	Study Design	Name of Intervention	Outcomes Measures	Results
Cantor et al., 2014	98	31-59	Randomized Controlled Trial (RCT)	Short-Term Executive Plus (STEP)	Executive functioning (EF; e. g., Behavioral Assessment of the Dysexecutive Syndrome)	EF: Statistically significant (p=0.008) Emotional Regulation: No significant improvement Attention: No significant improvement Generalization: No measured improvement
Chan & Fong, 2011	32	7-16	RCT	Problem-solving skills training (i.e. metacognitive strategies)	EF (e.g., BRIEF)	BRIEF: Statistically significant (p<0.003) Goal-Directed Behavior: Improved Abstract Reasoning: Improved Metacomponential function: Improved
Fong & Howie, 2009	33	18-55	RCT	Explicit problem-solving skills training (metacomponential approach)	EF (e.g., Behavioural Assessment of the Dysexecutive Syndrome; Metacomponential Interview)	Metacomponential Interview: Statistically significant (P=0.003) Effective for people with moderate TBI; ≥ 1 year post injury
Karver et al., 2014	132	12-17	RCT	Counselor Assisted Problem-Solving (CAPS)	EF (e.g., BRIEF)	Correlation between low vocabulary and EF: Statistically significant (p=0.003)
Kurowski et al., 2013	132	12-17	RCT	CAPS	EF (e.g., BRIEF)	Caregiver rated EF in older adolescents: Statistically significant (p<0.01), moderate effect size No stastistically significant changes in younger adolescents
Kurowski et al., 2014	132	12-17	RCT	CAPS	EF (e.g., BRIEF)	EF: Statistically significant in older adolescents (p<0. 05)
Man et al., 2006a	103	18-55	RCT	Analogical problem-solving skills training (computer-assisted, online- and therapist-administered)	Problem-Solving (e.g., author developed questionnaire, Category Test for Adults)	Problem-solving: Statistically significant (p<0.01) Self-efficacy: Improved (p<0.01)
Man et al., 2006b	50	18-55	RCT	Analogy problem-solving skills training	Problem-Solving (e.g., Category Test of the Halstead Reitan Test Battery [HRTB], Lawton Instrumental Activities of Daily Living [IADL] Scale)	General problem-solving: Statistically significant (p<0. 0005) IADL skills: Statistically significant (p<0.0005) Specific problem-solving tasks (e.g., covergent and divergent): Not statistically significant
Marshall et al., 2004	20	22-53	Phase I Study	Interactive Strategy Modelling Training (ISMT)	Task Specific Problem-Solving (i.e., Rapid Assessment of Problem-Solving)	RAPS-specific problem-solving: improved Learning effect: Modest; no significant difference between pre and post (p>0.05)
Miotto, et al., 2008	30	25-60	Randomized Controlled Crossover Study	Attention and Problem-Solving intervention (APS)	EF (e.g., Wisconsin Sorting Test, Virtual Planning Test, Verbal Fluency, Questionnaire from the Behavioral Assessment of the Dysexecutive Syndrome, Modified Multiple Errands Task)	EF measures: Not statistically significant MMET: Statistically significant
Rath et al., 2003	60	20-65	RCT	Problem-solving skills training (i.e. "Antecedent-Behavior-Consequences" analysis framework)	Problem-Solving/ EF (e.g., Wisconsin Card Sorting Test, Problem-Solving Inventory)	EF/problem-solving: Statistically significant improvement (p<0.05) Problem-solving self-appraisal: improved (p=0.005) Attention: Correlated with improved problem-solving self-appraisal (p=0.004) & EF (p=0.03)
Soong et al., 2005	15	18-55	Pilot Study	Analogy problem-solving skills training	Problem-solving (e.g., Lawton IADL, HRTB)	Problem-solving: statistically significant (Lawton IADL p=0.00; Category Test of HRTB p=0.001)
Wade et al., 2010	40	11-18	RCT	Teen online problem-solving (TOPS)	EF (e.g., BRIEF, BRIEF-SR)	EF: Improvement on self-reported measures; no improvement on parent-reported measures
Wade et al., 2018	152	11-18	RCT	TOPS - Family and Teen Only versions	EF (e.g., BRIEF)	EF: Greater improvements in TOPS-TO; family stress impacted self-reported improvements

Figure 1. PRISMA Flow Diagram



From: Moher D, Liberati A, Tetzlaff J, Altman DG, The PRISMA Group (2009). *P*referred *R*eporting *I*tems for *S*ystematic Reviews and *M*eta-

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Conclusions

- The overall quality of the studies reviewed was judged to be moderate
- Many of the studies revealed statistically significant results, although most of the outcomes were not clinically meaningful
- Problem-solving interventions alone are not sufficient for long-term EF improvements
- Problem-solving treatments should be used in conjunction with other treatment strategies for individuals with ABI

Recommendations

- More longitudinal studies are needed to evaluate generalization of EF skills post intervention
- A larger sample size should be used for future studies
- Sample population should be diversified in order to better represent the clinical population
- Implementation of outcome measures should expand beyond parent/self-report